museum of
science+industry
chicago

EXPLORE THE EARTH THIS SUMMER

Summer Brain Games offers eight free and fun at-home science experiments designed to combat the "summer brain drain." Everything is easily done at home with kids of all ages (and a little adult supervision).

This year, Summer Brain Games helps you understand how the Earth works and our impact on the planet, both positive and negative. Use recycled paper to make seed paper that will grow in your garden, measure the acidity of substances with a red cabbage concoction, build a weather station and make your own forecasts, and more. It's a great way for families with kids of all ages to stay active and enthused as they learn more about the world around them.

FREE MUSEUM ENTRY VOUCHER

Register at **msichicago.org/summerbrain** and get one free MSI ticket per household.

SUMMER BRAIN GAMES IS SPONSORED BY

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SUBWAY

RECYCLED SEED PAPER

Paper is made from tree fiber or recycled from previously used paper. Go green and recycle used paper by making paper that will sprout into flowers when planted in the garden.

MATERIALS

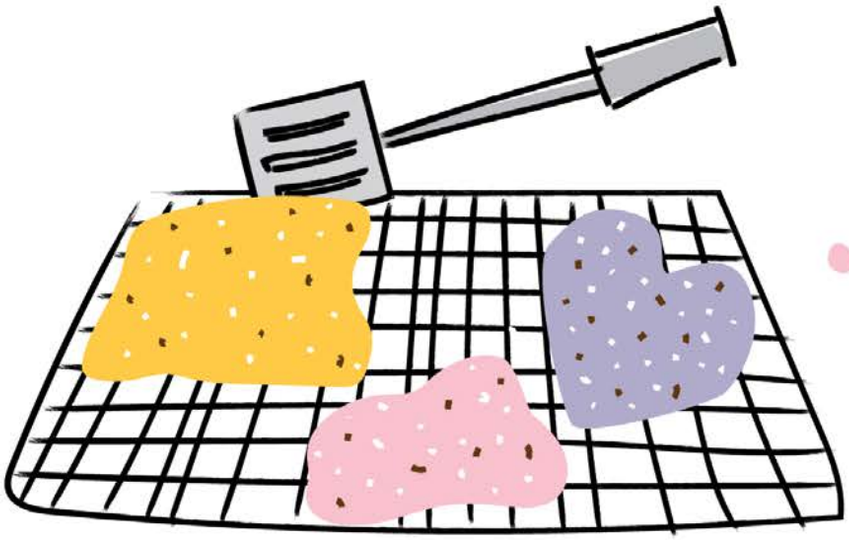
- ☐ **Used paper (notebook or copy paper works well)**
- ☐ **Water**
- ☐ **Blender**
- ☐ **Measuring cup**
- ☐ **Tablespoon**
- ☐ **Pitcher**
- ☐ **Spatula**
- ☐ **Colander**
- ☐ **Rolling pin**
- ☐ **Cooling rack**
- ☐ **Cheesecloth**
- ☐ **Two towels**
- ☐ **Food coloring**
- ☐ **Small seeds like wildflowers or herbs like parsley and thyme**

INSTRUCTIONS

Rip one or two pieces of notebook paper or copy paper into two-inch pieces. Place the paper pieces in a blender and add two cups of water. Blend the mixture until smooth. It should be very soupy. Add a few drops of food coloring. Pour the mixture into a pitcher and add a tablespoon of seeds. Mix with a spatula.

Make a double layer of cheesecloth and place it in a colander. Place the colander in a sink or large tub, and pour the paper mixture through the cheesecloth-lined colander. The paper pulp should remain behind in the cheesecloth and the excess water should run through. Gently press more water from the pulp using the spatula.

Lift the cheesecloth out and lay it flat on a towel. Use a spatula to shape the paper pulp into a square or rectangle if desired. Place another double layer of cheesecloth on top of the paper pulp and another towel on top of that. Press down on the top towel with a rolling pin to get as much water out as possible.



Remove the towels, take the paper out and gently peel the cheesecloth off both sides of the paper. Place the paper on a cooling rack to let it dry overnight. You can try using a hair dryer on a low setting to speed up the drying process, but too much heat will damage the seeds.

Once the paper is completely dry, you can write, draw and even paint on your paper. Send a postcard or a thank you note. You can even plant the paper in soil, keep it moist, and watch for the seeds to germinate and flowers grow!

WHAT'S HAPPENING?

Fiber is a key part of making paper. Plant material contains the fiber cellulose, which is like the stringy bits of celery. Copy paper and other types of paper that are thin and perfectly smooth are made of small but strong fibers that interlock and stay together. When you blended paper with water and made pulp, all the fibers got broken up. When you poured the pulp onto cheesecloth and squeezed out all the extra water, the fibers interlocked again and held the paper together. Those fibers are also good at holding water. So when you plant your seed paper and water it, the fibers hold the water so the seeds can sprout. The paper will naturally break down in the soil as your seeds grow into plants.

TIPS

Your paper will likely be thick and stiff. Specialized equipment in paper mills is needed to make thin, smooth paper like we use in notebooks or with copy machines. Try to make thinner paper by using less paper in the blender and spreading it over a larger area of cheesecloth.

EXTENSIONS

Paper making is as much art as it is science. There are all kinds of ways to decorate your paper as you make it. Place flowers, leaves, confetti, and other decorative bits in the pulp before you dry it. You can also add paint or dyes at different steps of the process for different effects—try adding paint while the paper is drying on cheesecloth. Play around and be creative!

LEARN MORE

The vertical farm in MSI's *Fast Forward: Inventing the Future* exhibit showcases innovative ways to grow food in urban areas.

RECOMMENDED READING

Trash Revolution: Breaking the Waste Cycle, by Erica Fyvie

Norton and Alpha, by Kristyna Litten

EGG CARTON NURSERY

Attract helpful bees to your garden by making an egg carton nursery and planting flower seeds that bees like. Then observe bees pollinating the flowers as they travel from flower to flower.

MATERIALS

- ☐ **Egg carton (paper type, not Styrofoam)**
- ☐ **Pencil**
- ☐ **Potting soil**
- ☐ **Flower seeds like alyssum, geraniums, poppies, aster, lavender and black-eyed Susan**
- ☐ **Plate or tray**
- ☐ **Bowl**
- ☐ **Spray bottle**
- ☐ **Water**
- ☐ **Coffee grounds (optional)**

INSTRUCTIONS

Use a pencil to carefully poke three small holes in the bottom of each individual egg cup. Fill each egg carton cup three-quarters full with potting soil. As an option, you can mix used coffee grounds with potting soil in a ratio of three-quarters soil to one-quarter coffee grounds.

Place a few seeds in each cup, then cover with a thin layer of potting soil. Alyssum, geraniums, poppies, aster, lavender, and black-eyed Susan flowers are local, native wildflowers that are known to attract bees.

Place the egg carton on a waterproof plate or tray and place it in a warm, sunny spot inside your house.

Spray a small amount of water on the carton every other day, keeping the soil moist but not soaked. If you see water coming out of the bottom of the egg cups, you're adding too much water! Keep seeds indoors for four to five weeks. Once the seeds sprout and have multiple sets of strong leaves, they can be taken outside for the bees to enjoy.

Egg cartons made of paper can be planted directly in the ground because they will biodegrade. Egg cartons made of Styrofoam will not break down and should not be placed into the ground.

Cut the egg carton into individual cups and transplant the small plants into the ground or larger pots. Make sure you choose a sunny area for planting, depending on the type of plants that you sprouted. Check the seed packets for the best sunlight conditions for your plants.

WHAT'S HAPPENING?

For the first few days, you probably didn't see much going on in your garden but under the soil the seed has germinated. That means it started using the energy stored as food inside the seed to make its first root and leaves. The roots grow down and the leaves grow up. After about a week, little green stems should poke out of the soil. Once the first leaves appear, they capture sunlight to create food, allowing the plant to grow. The process of plants using sunlight to make food is called photosynthesis.

Flowers attract bees, and bees are important because they are critical in producing food. Bees pollinate crops. Pollination is required for plants to make seeds. Tiny grains of pollen carry the genetic information of a plant. Pollen grains are the yellow dust you see in flowers. Bees and other pollinators get those pieces of pollen stuck to their bodies as they travel between flowers. The pollen then gets stuck on other flowers of the same species. The pollen then fertilizes the flower, which is the first step in making a new seed.

Bumblebees, other wild bees and insects like butterflies, wasps and flies all pollinate. A lot of the food we eat depends on pollinating insects—fruits like peaches, strawberries, and apples are all pollinated by bees. Declines in bee populations in recent years have reduced crop yields for almonds in California.

TIPS

Some people are allergic to bee stings, so when choosing a place to plant the seed cups outside choose an area that is good for the bees as well as for people.

EXTENSIONS

Become a citizen scientist and volunteer for BeeSpotter. University of Illinois researchers need your help collecting information about bees. Sign up and submit your photos of bees at beespotter.org Your data will become part of a nationwide effort to gather information on the population of these important pollinators.

LEARN MORE

Explore innovations in farming and food production in MSI's *Farm Tech* exhibit.

RECOMMENDED READING

Give Bees a Chance,
by Bethany Barton

From Seed to Plant,
by Gail Gibbons

PH RAINBOW

We encounter acids and bases every day in the food we eat and the household cleaners we use–like bleach, vinegar and milk. In chemistry, the pH scale tells you how acidic or basic a substance is. Make your own simple pH indicator and do some testing!

MATERIALS

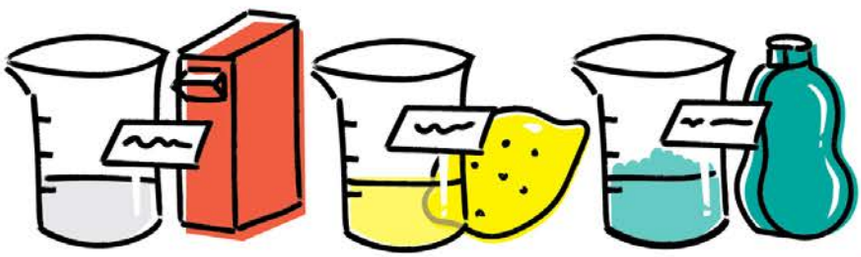
- ☐ **Red cabbage (doesn't work with green cabbage!)**
- ☐ **Knife**
- ☐ **Cutting board**
- ☐ **Measuring cup**
- ☐ **Measuring spoons**
- ☐ **Boiling water**
- ☐ **Two large bowls or containers**
- ☐ **Several smaller containers**
- ☐ **Strainer**
- ☐ **Sticky notes**
- ☐ **Substances to test like lemon juice, vinegar, milk, clear soda, baking soda, soapy water**

INSTRUCTIONS

With the help of an adult, chop the cabbage into small pieces (about half an inch). Place all the pieces in a large bowl. Boil four cups of water. Take the water off the heat and carefully pour the hot water over the cabbage. Let the cabbage sit until it cools to room temperature.

Pour the mixture through a strainer and collect the liquid in a second container. This is your pH indicator. The color should be bright purple. Be careful, it can stain.

Prepare your substances for testing. Put about a quarter cup of a substance into a small container and label it using a sticky note. Repeat, placing substances in separate containers until you have all your samples ready. For powders like baking soda, mix one tablespoon into a quarter cup of water.



Add a few tablespoons of the cabbage juice pH indicator to each small container. Check the color and match it to the pH scale chart to determine how acidic or basic the substance is. Refer to the pH scale below or at https://tinyurl.com/phcolorscale.

RED CABBAGE COLOR INDICATOR CHART

WHAT'S HAPPENING?

Scientists monitor the chemical and physical properties of natural water, like our rivers and lakes. Changes in pH levels and properties like acidity, temperature, density and the concentration of different chemicals can have a profound impact on the health of the living organisms in the water. For example, organisms that use calcium carbonate to build shells—like oysters, clams, sea urchins and corals—are especially sensitive to changes in pH levels. Conditions that are more acidic, or lower on the scale, make it harder for them to build shells. The National Oceanic and Atmospheric Administration is studying whether rising levels of carbon dioxide is making the Great Lakes more acidic.

TIPS

When disposing of the substances you tested, pour each one down the drain individually with plenty of water.

If you spill red cabbage juice on your clothes, blot as much excess liquid as possible and run the hottest water that is safe for the fabric through the stain. Use laundry detergent or stain remover and wash normally.

EXTENSIONS

Red cabbage makes a very broad pH indicator. If you want to test natural waters from lakes, streams or rain, you can purchase more accurate pH strips from a pet store. Does the pH of a nearby lake or stream change over the seasons? Is the pH of the rain and in bodies of water the same?

LEARN MORE

Explore other chemicals and see what reactions they create with MSI's online goREACT game (msichicago.org/goreact).

RECOMMENDED READING

Rachel Carson and Her Book That Changed the World, by Laurie Lawlor

Humans and the Hydrosphere: Protecting Earth's Water Resources, by Ava Sawyer

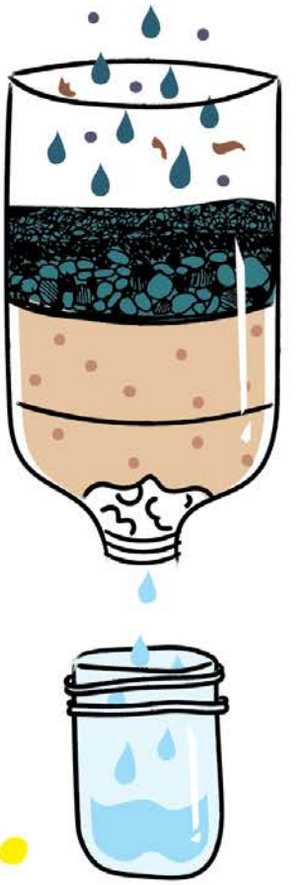
WATER FILTER

The water we drink comes from lakes, rivers and underground aquifers but is filtered, cleaned and treated before it gets to us. The wastewater we create is also filtered, cleaned and treated before being returned to the environment. Make some "dirty" water and use different filtration techniques to see how clean it can get.

MATERIALS

- ☐ **Plastic beverage bottle (1-liter or 20-ounce bottle is best)**
- ☐ **Jar or vase that the plastic bottle fits into**
- ☐ **Pitcher or other container**
- ☐ **Sand**
- ☐ **Gravel**
- ☐ **Cotton balls**
- ☐ **Cooking oil**
- ☐ **Napkins or paper towels**
- ☐ **Scissors**
- ☐ **Spoon**
- ☐ **Measuring cup**
- ☐ **Soil**
- ☐ **Water**

INSTRUCTIONS



With help from an adult, cut the bottom inch off the plastic beverage bottle and remove it. Turn the bottle upside down and place it in a jar or vase to hold it upright while you build the filter. Make the bottom layer of your filter by adding cotton balls in the tapered end, packing them tightly in the bottom third of the bottle. Add a little water to the cotton balls to help them stay packed and in place. Next, add the sand to the filter—make the sand layer about three inches thick. Finally, add a one-inch gravel layer, being sure to leave an inch of space above the gravel. Pour one cup of clean water through the filter to wet the sand and cotton. Discard the water that comes out of the filter.

Make "dirty" water by filling a pitcher or container with about one liter of water. Add one cup of soil and stir thoroughly. Add a few drops of cooking oil and mix well. Now your water is ready to be filtered!

Slowly pour your dirty water in the filter one cup at a time. Wait until there is no standing water on top of the gravel before adding the next cup. Watch what happens as it comes in contact with each layer of the filter. What do you notice? What does the water that drips out of the bottom of the filter look like? What do you think each layer is removing?

The water that comes out of your filter should be clearer and cleaner than it started, but it has not been treated for bacteria and is not safe to drink. Use this water for something like watering your plants.

WHAT'S HAPPENING?

Water filters are used to remove impurities and solid particles from water to clean it. As the dirty water moves through the filter, each layer removes a different size or type of particle while letting the water molecules pass through. Once the water reaches the bottom, the filter has caught the debris and leaves clean, clear water. Each layer has a special job. The top gravel layer filters larger sediment and debris, like trash, rocks and leaves. The sand layer filters fine impurities and organisms and can even help remove some bacteria and parasites. The cotton balls help remove any remaining contamination (like oil) that passed through the sand layer.

TIPS

The flow rate (or speed) of the water as it passes through the filter is important. The more time the dirty water is in contact with the filter layers, the more impurities can be removed. So pour the dirty water into the filter slowly.

EXTENSIONS

Experiment by modifying your filter layers. Try using two types of sand, such as a fine-grained sand and a coarse-grained sand. Add the finer sand first, on top of the cotton ball layer, and place the coarse-grained sand on the fine-grained sand. Make another filter using only two layers—you pick which ones to try! What's different? Does the water come out of the filter any clearer? Does the water travel through the filter faster?

LEARN MORE

Chicago's Jardine Water Purification Plant is one of the largest in the world and provides almost one billion gallons of water a day to the city and suburbs. The plant uses filter screens and chemicals in addition to gravel and sand to make safe drinking water.

RECOMMENDED READING

You Wouldn't Want to Live Without Clean Water! by Roger Canavan

Maker Lab Outdoors—25 Super Cool Projects: Build, Invent, Create, Discover, by Jack Challoner

NATURE I SPY

Go outside and really look around. There are living things everywhere! It's easy to think about nature in wild places–like herds of elk in the Rocky Mountains, alligators in Florida or elephants roaming the African savannah. But even in our own backyards, on sidewalks and in the park, there are lots of amazing living things.

MATERIALS

- ☐ **Nature Bingo card (available at msichicago.org/summerbrain)**
- ☐ **Notebook**
- ☐ **Pencil or pen**

INSTRUCTIONS

Find a notebook to use as a nature journal. You can even make your own by cutting pieces of paper to the size you want and stapling them together. Go for a walk and give yourself a nature observation challenge using the questions below. Or, make a game of it by using our Nature Bingo card.

HOW MANY KINDS OF TREES CAN YOU FIND?

You may not know the name of a tree, but you can find differences by observation. What is the shape of its leaves? What does the bark look like? What is the overall shape of the tree? Write a description and draw pictures. How many trees are in your park or on your block?

WHAT INSECTS DO YOU SEE, AND WHAT ARE THEY DOING?

The best way to find out what busy insects are doing is to observe. Ants and bees are easy to watch because you can find them everywhere. Look for bees in a patch of flowers. As long as you are cautious and keep your distance, bees shouldn't bother you. Find one bee and follow it. Where does it go? How long does it spend in each flower? Do you see yellow powder or pollen on its back? Are there other bees around? Look for ant colonies or other insects. Watch what they do and count how many you see. Record your observations in your journal.

WAS THAT THERE YESTERDAY?

One of the amazing things about the natural world is it changes every day. Plants and flowers grow, birds make nests, and spiders and mosquitos seem to appear out of nowhere. Try to observe these changes as they happen. Pick something outside that interests you, like a patch of flowers, a tree that attracts a lot of birds, or an animal that hangs out in the same spot. Visit the same place every day and see if there is something new or changing. Write it in your journal and, over time, you may see a pattern of behavior or the life cycle.

WHAT'S HAPPENING?

Scientists who study the natural world are called biologists. There are different types of biology—botanists study plants, zoologists study animals, and ecologists study how different populations interact—but all of them rely on observation. There are many formal ways to record and analyze animal behavior including ethograms where every action and behavior an animal does is recorded for a set period of time. For now, the most important thing is to pay attention and investigate something that interests you.

Famous scientists like E.O. Wilson and Charles Darwin relied heavily on nature walks and journals to not only track their progress, but to review and think philosophically about the intertwined nature of all things. This type of observation and recording of thoughts have helped to bring about some of our most important scientific discoveries.

TIPS

Make sure you are with a parent or caregiver if you are exploring away from your home.
Pay attention to your surroundings so that you stay safe.

LEARN MORE

Find educational resources at the North Park Village Nature Center in Chicago (chicagoparkdistrict.com) or Cook County Forest Preserve nature centers located throughout the region (fpdcc.com/nature-centers).

RECOMMENDED READING

Outdoor Science Lab for Kids: 52 Family-Friendly Experiments for the Yard, Garden, Playground, and Park, by Liz Lee Heinecke

Hidden City: Poems of Urban Wildlife, by Sarah Grace Tuttle

DIY CLOUD

Clouds aren't always wanted, especially when they bring rain. But you can control the clouds yourself with this classic experiment.

MATERIALS

- ☐ **Plastic 1-liter bottle with cap**
- ☐ **Hot water**
- ☐ **Measuring cup**
- ☐ **Match (with adult supervision)**

INSTRUCTIONS

Make sure the plastic bottle is empty and clean. Heat one cup of water so it is hot, but not boiling.

Hold the bottle upside down. With an adult helping you, light a match and hold it under the opening of the bottle so the smoke rises into the bottle. Lift the match so it continues to burn while just inside the bottle. Blow the match out and capture the additional smoke in the bottle.

Turn the bottle and hold it slightly angled up so you can carefully pour the hot water into the bottle. Pour about half an inch of water in the bottom and tightly place the cap on the bottle. Squeeze the bottle repeatedly. Does anything happen?

After several squeezes and releases, a cloud should form in the bottle that looks like fog. When you squeeze the bottle, it should clear up and then become cloudy again when you release the pressure.

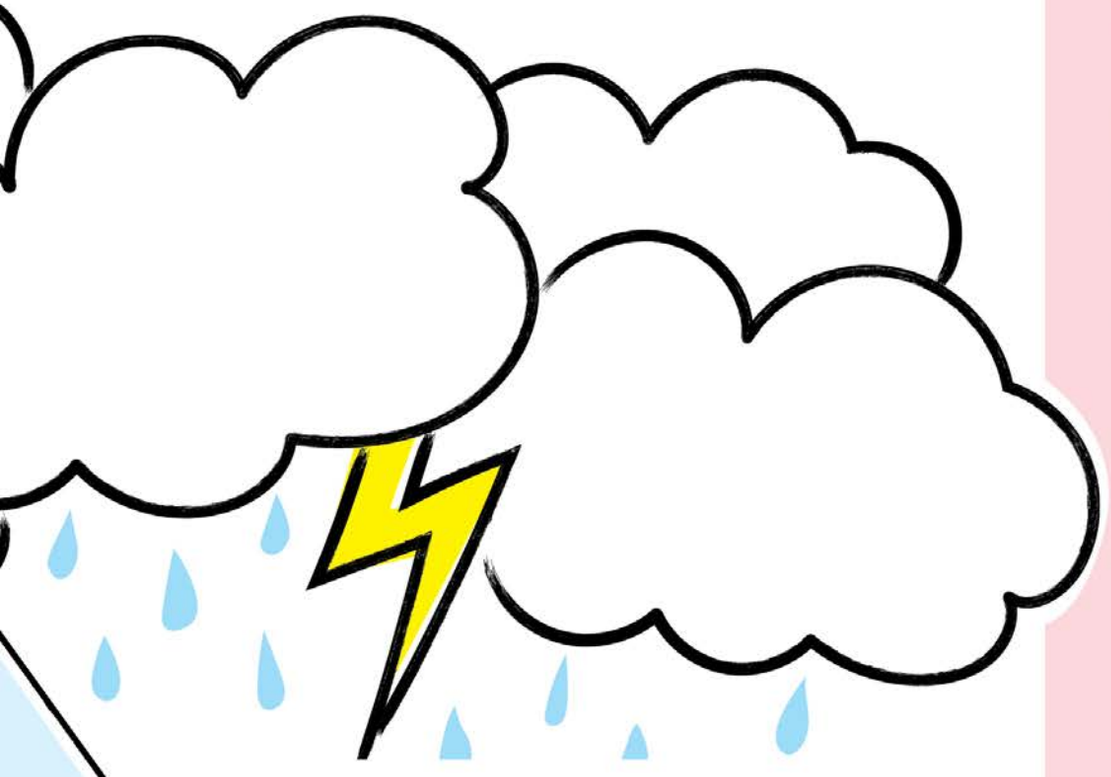
WHAT'S HAPPENING?

This experiment creates a model of a cloud system in a bottle. Clouds form every day around the world. How and when clouds form depends on a few factors including temperature, pressure, water vapor and dust.

Water vapor exists in the atmosphere as individual water molecules bouncing around like the other gases in our atmosphere (nitrogen, oxygen, carbon dioxide and others). The amount or concentration of water vapor varies. When it feels humid outside, there is more water vapor in the air. In the winter, there is less water vapor and the air feels drier.

The amount of water vapor the air can hold depends on temperature. In this experiment, we manipulate the temperature inside the bottle with pressure. When you squeeze the bottle, you increase the pressure inside which raises the temperature. When you let go, the pressure and temperature drop. With lower pressure and lower temperature, water vapor comes together in tiny droplets and a cloud forms.

Why do we add smoke? The cloud effect is more dramatic when there are tiny particles in the air like smoke or dust. Those particles give the water molecules someplace to clump together as they form. So adding smoke particles to the bottle makes it easier for a cloud to form and easier to see. Clouds in the sky naturally form with dust and other particles in our atmosphere.



TIPS

Only use matches with adult supervision!

EXTENSIONS

Make another weather phenomena in a bottle—a tornado! Fill a plastic 1-liter bottle about two-thirds full with water. Place a metal washer on the top of the bottle and put another plastic 1-liter bottle upside down so its top is also on the washer. Connect the two bottles by wrapping their tops (and the washer) with duct tape, creating a seal. Quickly turn the bottles over and place them upright on a table. Move the bottles in a circle and watch the water spiral into a vortex as it drains into the lower bottle.

LEARN MORE

The 40-foot vortex in MSI's *Science Storms* exhibit makes a swirling cloud using ultrasonic vaporizers.

RECOMMENDED READING

The Cloud Book, by Tomie DePaola

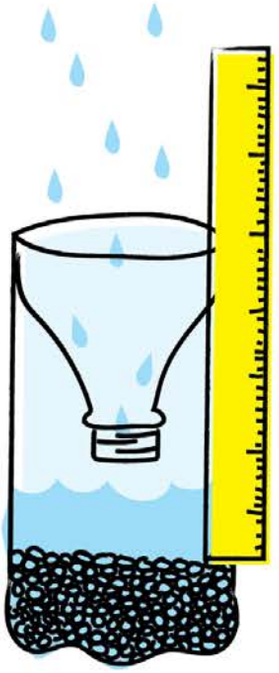
Water is Water: A Book About the Water Cycle, by Miranda Paul

WEATHER STATION

Scientists observe and record natural events using tools for precise measurements. You can do this by building your own weather station to record the weather events that happen in your backyard. Make a rain gauge, wind vane, anemometer and barometer, then collect and compare data and even make your own weather forecasts.

RAIN GAUGE MATERIALS

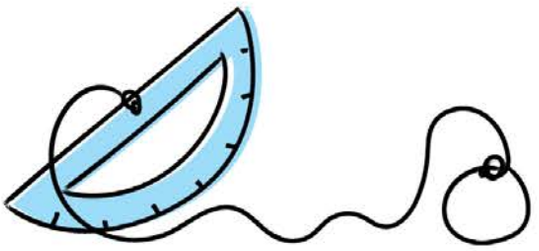
- ☐ **Plastic 1- or 2-liter bottle (with straight—not curved—sides)**
- ☐ **Gravel**
- ☐ **Ruler**
- ☐ **Tape**



INSTRUCTIONS: Cut off the top fourth of a one- or two-liter bottle. Add about two inches of gravel to the base of the bottle. Tape a paper ruler on the outside of the bottle with the "0" mark at the top of the gravel. Add water until it reaches the top of the gravel. Make a funnel by inverting the top of the bottle that you cut off, placing it inside the base and covering the cut edges with tape. When it rains, measure the rainfall amount on the ruler.

ANEMOMETER MATERIALS

- ☐ **String**
- ☐ **Ping pong ball**
- ☐ **Thermometer**
- ☐ **Scissors**
- ☐ **Tape**
- ☐ **Protractor (available at msichicago.org/summerbrain)**



INSTRUCTIONS: Tape one end of a piece of string to a ping pong ball and the other to the center of the straight edge of a protractor. Hold the anemometer with the straight edge on top, parallel to the floor. Note the angle of the string when the wind blows, then use it to calculate the wind speed; check the chart on our protractor template.

BAROMETER MATERIALS

- ☐ **Small jar or cup, such as a yogurt cup or juice glass**
- ☐ **Balloon**
- ☐ **Tape**
- ☐ **Index card or piece of thick paper**
- ☐ **Straw**
- ☐ **Rubber band**
- ☐ **Scissors**

INSTRUCTIONS: Cut the neck off a balloon, stretch the balloon over the top of a jar or small cup and secure it with a rubber band. Cut a straw in half and trim at an angle to make a point. Tape the straw to the balloon so the end is in the center and the pointed end extends over the edge of the jar. Tape should run along the full length of the part of the straw that's on the balloon, reaching to the edge of the jar. Make a gauge by folding an index card in half so that it stands next to the straw (the index card should be about twice as tall as the jar). Mark on the gauge the location where the straw points each day.

GENERAL MATERIALS

- ☐ **Thermometer**
- ☐ **Tray or box**
- ☐ **Weather log (available at msichicago.org/summerbrain)**

Assemble your instruments, then put them all together on a base (like a tray or a box) to make an all-in-one weather station. Add a thermometer so you can track the temperature. Thermometers are difficult to make, so it's best to buy an inexpensive thermometer. Put your weather station outside and collect your data.

WHAT'S HAPPENING?

Weather describes the temperature, humidity, atmospheric pressure, wind, rainfall and other meteorological characteristics of the atmosphere in a specific place at a specific moment in time. Instruments help measure the weather. A rain gauge measures how much rain falls at a time. An anemometer measures the speed of the wind. A barometer measures air pressure; low or falling pressure (when the straw points downward) means a storm is approaching, while high or raising pressure (when the straw points up) means sunny weather.

EXTENSIONS

Collect data all summer on a weather log, including the temperature and observations on what you see (sun, clouds, etc.). Guess what tomorrow's weather will be by using the patterns you have observed from your weather station. You can even make a video forecast like a TV meteorologist, then check the next day to see if you're right.

LEARN MORE

Watch weather formations across the globe in MSI's *Earth Revealed* Exhibit.

RECOMMENDED READING

Down Comes the Rain, by Franklyn M. Branley

Magic School Bus Presents: Wild Weather, by Sean Callery

INSULATION CHALLENGE

Insulation helps keep your house warm in the winter and cool in the summer, which reduces energy costs. The Earth's atmosphere is also an insulator–it absorbs heat from the Sun and keeps heat inside the atmosphere, helping the Earth to stay warm. Experiment with insulation to see if you can keep an ice cube from melting.

MATERIALS

- ☐ **Four small paper cups (3-ounce cups work well)**
- ☐ **Four clear plastic cups (16-ounce cups work well)**
- ☐ **Aluminum foil**
- ☐ **Newspaper**
- ☐ **Felt, wool, bubble wrap, fabric or other insulating materials**
- ☐ **Plastic wrap**
- ☐ **Rubber bands**
- ☐ **Tape**
- ☐ **Scissors**
- ☐ **Four ice cubes that are the same size**
- ☐ **Timer**
- ☐ **Marker**

INSTRUCTIONS

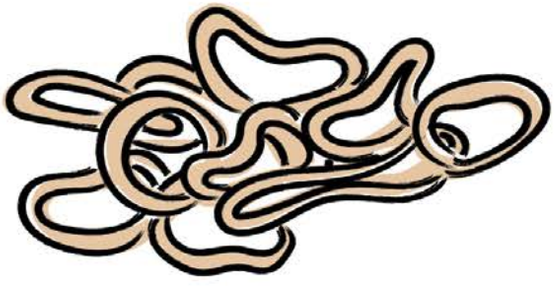
Test which materials work best to keep an ice cube from melting. Cover the outside of one 3-ounce paper cup with aluminum foil, trimming it to fit and taping it into place. Cover another paper cup with newspaper, and a third with a different material you would like to test. Leave the fourth paper cup uncovered.

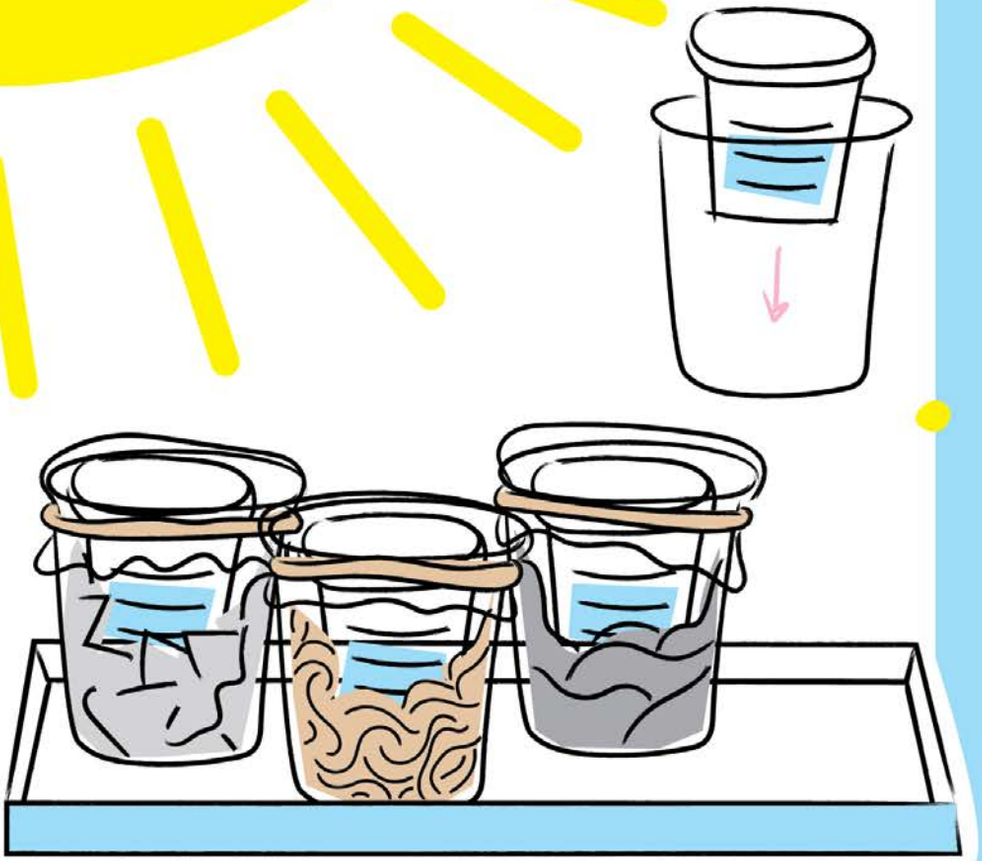
Place each paper cup into a larger plastic cup. If needed, add more insulation material to fill the gap between the cups. Add an ice cube to each paper cup. Cover the top of each large cup with plastic wrap, using a rubber band to hold it in place.

Put your cups in a warm place like a sunny ledge or place them in a shallow pan of warm water. This will help your experiment go faster.

Set a timer for five minutes. Observe the cups and note how much water has melted. Take the small cups out of the big cups and draw a line at the level of melted water. Place the small cups back into the larger cups and set the timer for another five minutes and observe again.

The insulator material that resulted in the least amount of melting worked the best.





WHAT'S HAPPENING?

Insulators stop the transfer of energy from an object to its surroundings. They hold temperatures constant, keeping cold objects cold and warm objects warm. With good insulation, the speed at which an ice cube melts is slowed down. A good insulating material will not let warmer surrounding air reach the ice cube and will keep the cool air of the ice cube from escaping, allowing the ice cube to hold its shape for a longer time.

Insulation in your home works the same way. It keeps cool air conditioning from escaping while at the same time keeping hot air outside from getting in. The same idea applies to your coat in winter. The coat keeps the cold outside air from reaching your body and also keeps the heat of your body from escaping, so you stay nice and warm.

EXTENSIONS

Try this experiment again using different insulators. Wrap the cups with felt, wool, fabric or bubble wrap. Add a thicker layer of insulation between the paper cup and the surrounding clear plastic cup. Does adding more layers of insulation change the time it takes for the ice cube to melt? What effect does different insulation have on melting speed?

LEARN MORE

See dramatic images of the pace of the world's glaciers melting in MSI's *Extreme Ice* exhibit.

RECOMMENDED READING

Sizzling Science Projects with Heat and Energy, by Robert Gardner

Ice Boy, by David Ezra Stein

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